Additive manufacturing coming of age

Understanding materials is crucial to new processes for weapon parts

By Sue Major Holmes

Sandia researchers are exploring how to use additive manufacturing, familiar to most people as 3-D printing, to make parts for nuclear weapons and other national security needs, saving time and money and simplifying the manufacturing process.

The target of much of its research is an advanced metal additive process that uses a laser to melt successive layers of metal powder to build up shapes. The technique lets engineers design in ways that aren't possible with standard manufacturing methods and could make components that perform better and weigh less. But researchers must answer hard questions before they can certify that parts made in non-traditional ways can meet high-consequence requirements.

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President Barack Obama has pushed for ways to strengthen US manufacturing. Last year, Sandia joined America Makes, the federally backed National Additive Manufacturing Institute, which aims to reduce the cost of 3-D printing, offer new opportunities to businesses, and train American workers in sophisticated technologies. Ultimately, a robust additive manufacturing industry could make the nation more competitive in a global market.

(Continued on page 4)

MATERIALS ASSURANCE — Bradley Jared (1832) sits in front of a new selective laser melting machine at Sandia for metal additive manufacturing (AM) as he holds two prototype housings designed through a technology called topology optimization. Sandia researchers who are exploring additive manufacturing for nuclear weapons and other national security needs say they need to understand how AM processes affect the properties of materials that are generated. (Photo by Randy Montoya)

Sandians honored by HENAAC

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Jim Chavez named VP of Energy, Nonproliferation, and High Consequence Security Div. 6000

Will also lead International, Homeland, and Nuclear Security PMU

Jim Chavez has been named VP of Energy, Nonproliferation, and High Consequence Security Div. 6000 and the International, Homeland, and Nuclear Security Program Management Unit effective Sept. 11. He replaces Jill Hruby, who became Sandia president and Laboratories director in July.

Most recently, Jim served as the director of Monitoring Systems and Technology Center 5700 and the Remote Monitoring and Verification Program, where he oversaw the research and development of sensor technologies for treaty monitoring and arms control, the satellite payloads and ground-based analysis systems that comprise the US Nuclear Detonation Detection System, and other technical national security products for NNSA and other government agencies.

"Jim's distinguished career both as a researcher and a visionary leader at Sandia has made an impact on the major research and development portfolios he will be overseeing in his new role as vice president," Jill said in announcing Jim's appointment. "I congratulate him on his new position and I am confident that he will continue to deliver with excellence on Sandia's important national security mission."

In his 33-year career at Sandia, Jim has served in a variety of leadership roles and has broad research experience in the areas of renewable energy, nuclear reactor safety, and physical security. He served as a congressional fellow for the American Society of Mechanical Engineers in Washington, D.C. He was a director of the Systems Research and Analysis Center and the Proliferation Assessments Program; manager of Sandia's Government Relations Department; and manager of the Solar Thermal Test Department and the National Solar Thermal Test Facility.

DIV 6000 VP Jim Chavez. (Photo by Randy Montoya)

"I'm honored to be appointed vice president and look forward to leading Sandia's efforts to provide high-impact technologies and innovative technical solutions for challenges in energy, nonproliferation, security, satellite and ground sensing, and other fields," Jim says.

Jim joined Sandia in 1981 as a researcher in Intrusion Detection Systems. His early research included the development and demonstration of renewable energy technologies and he became an expert on molten salt systems, used to store heat from solar power systems, and solar power tower technologies. He authored more than 20 technical publications and articles on solar thermal energy.

Jim is a graduate of Eldorado High School in Albuquerque. He received a bachelor's degree in mechanical engineering at New Mexico State University in Las Cruces, New Mexico, and a master's degree in mechanical engineering at the University of California-Berkeley.

Jim, a member of the Executive Diversity Team at Sandia, received the Hispanic Engineer National Achievement Award for professional achievement in 1997 and serves on the National Hispanic Cultural Center Foundation Board in Albuquerque.

He is an active member of the American Society of Mechanical Engineers and the NMSU Mechanical Engineering Advisory Board.

Computer donation

Retired computers used for cyber research at Sandia have found a new life at Northern Humboldt Union High School District in McKinleyville, California, where Sandia has donated 242 computers for science education. **See page 3.**

Inside . . .

NMSBA: With a little help from our friends

The New Mexico Small Business Assistance Program lends a hand — and technical expertise — to small businesses with big ideas, like Taos Mountain Energy Foods. **See page 9.**

That's that

If you've been around Sandia for a while, you likely remember Bruce Hawkinson, the one-time editor of the *Lab News*, the first voice you heard on Radio Sandia, and the founder/editor of *Sandia Daily News*.

I'm saddened to report that Bruce, who retired in 2002, passed away in Albuquerque on August 30. He was 77.

Bruce was one-of-a-kind, certainly the most dedicated employee communicator I've worked with in 35 years in this business, the past 20 here at Sandia.

He was a tireless advocate for keeping "the troops" (as he called his fellow Sandians) informed openly and honestly. He ran the *Lab News* and his other enterprises as no-spin zones. "If all I did was spew the management line," he once said, "I'd lose my credibility; but more to the point, no one would read it [*SDN*]. . . and that wouldn't serve the Labs' purpose at all."

When Bruce retired, I wrote a story for the *Lab News* about his departure, something we didn't often do — then or now — for retirees below the level of VP.

Bruce merited the story, we thought, for two reasons: For one thing, he had been editor of the publication and it's a tradition in the business to take note of such transitions. And then there was this: There probably wasn't a Sandian of his generation, short of the VPs or Labs director, who had a higher profile than Bruce. Everyone knew him, even if only by name and voice.

And oh, what a voice it was! You know those guys who do the voice-overs for action movie trailers? Bruce could have walked into any studio in California, spoken a few words and been hired on the spot to do those trailers, so mellifluous were those pipes of his.

In that 2002 *Lab News* story, I referred to Bruce as "Mr. Communicator." That was accurate, but as I reflect back on it now, I think it was too limiting. Bruce was "Mr. Sandia." He loved this place, loved being a Sandian. At the time of his retirement I wrote,

> *"So closely was Bruce associated with his work and such clear relish did he take in it, that his closest colleagues . . . were convinced that he would somehow plug on forever. They were sure that somehow, defying all the actuarial odds, two generations from now, long after they were scattered to RV parks from Scottsdale to Sarasota, Bruce would still be bounding in at 5:30 a.m., his familiar white beard a bit longer, his hair a bit thinner, but still in fighting trim, rarin' to get another trademark Wry Bye [a quote-of-the-day feature that used to appear in Bruce's SDN] out to the holodecks of Sandians circa 2036."*

In the years since his retirement I had sporadic contact with Bruce. He remained a devoted reader of the *Lab News* and he'd call me from time to time to say he appreciated reading this story or that, enjoyed a column item I'd written, or taken issue with something going on at his beloved Sandia.

When he first took on the job as *Lab News* editor in 1982, Bruce wrote a column introducing himself to readers. The column was essentially a statement of principles he intended to live by as editor. He wrote:

> *We'll try, as we always have, to reflect the achievements and interests of the Sandia community. . . . I will push to include in tech stories some indication of the creative insight that led to the discovery, or the process, or the product. . . . We will continue in our attempt to capture not only the what but the why of management pronouncements — not only to maintain our own credibility but to enhance management's credibility within our readership. Finally, we'll try to be interesting — interesting enough to lure you into reading us, maybe even enjoying reading us.*

Bruce tried to run the paper by those principles, and if you look back at the *Lab News* of his era, you'll see that he largely succeeded. He set a high bar for those of us who followed him in this role. They say no one is indispensable and I believe that's true. But as I think about Bruce and the role he played here for more than three decades, I believe this too: Sandia has missed him — his insights, his wisdom, his commitment, and his professional integrity — every single day since he's been gone. So long, friend.

See you next time.

— Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)

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Employees, retirees . . .

OPM says notifications coming soon in cyberattack data breach

The US Office of Personnel Management reports that it will soon begin notifying more than 20 million individuals affected by widely publicized cyber-attacks in which background investigation records were stolen. According to the OPM website (www.opm.gov/cybersecurity), "We will begin to notify people affected by the background investigation incident in the coming weeks. At that time, you will be auto-enrolled in some [identity theft] services and will need to take action to enroll in others."

The OPM data breach involves the records of individuals who underwent a background check for a government security clearance in the year 2000 or later. Almost all current Sandia employees are likely affected, as are retirees who underwent reinvestigations in the past 15 years.

Compromised data includes: Social Security numbers; residency and educational history; employment history; information about immediate family and personal and business acquaintances; and health, criminal, and financial history.

According to the OPM website, "At this time, there is no information to suggest misuse of the information that was stolen from OPM's systems."

To keep informed immediately when OPM updates the information on its website, you can subscribe to an RSS feed or an email updates list, like OPM on Facebook or follow OPM on Twitter. These options are available via https://www.opm.gov/cybersecurity/stay-informed/.

Sandia donates 242 computers to Northern California school district

COMPUTER MIGRATION — Mitch Williams prepares the disassembly of 242 computers for delivery to Northern Humboldt Union High School District in McKinleyville, California. (Photo by Dino Vournas)

By Michael Padilla

Sandia *Exceptional service in the national interest* CaliforniaNews

Retired computers used for cyber security research at Sandia National Laboratories have found a new life at Northern Humboldt Union High School District in McKinleyville, California.

Thanks to Sandia, 242 computers were donated to the school district to help improve the math and science education programs in five schools serving seven communities on California's rural northern coast. The computers will also be used to help improve technical and scientific education research activities in the district.

The computers, previously housed at Sandia/California, had been used to emulate large networks of computers using virtual machines. Keith Vanderveen (8956) says Sandia/California ran 100s to 1,000s of virtual machines (full instances of an operating system such as Windows) on each physical machine. Using a cluster of 521 machines could emulate a network of up to half a million computers. To read about some of the research conducted on the computers at Sandia, see a 2012 news release at http://tiny.sandia.gov/ffuol.

"We used this cluster of computers to test and improve tools, and then we ran even bigger experiments on supercomputers such as Jaguar at Oak Ridge National Laboratory, which has tens of thousands of nodes." Keith says. "This allowed us to emulate networks with tens of millions of computers. This work has applications in cybersecurity, since we can test new security protocols, software, etc. on an emulated testbed before deploying it in the real world."

Todd Curry, director of technology at the Northern Humboldt Union High School District, says the donation will free up technology funds to help put more tools such as laptops and tablets directly into the hands of the district's students.

"The generous donation of 200-plus computers from Sandia made a huge impact on how we will utilize our technology budget this year," Curry says. "Many of the instructional computers used by faculty in our classrooms are seven to 10 years old. Our technology budget was earmarked to replace up to 100 desktop computers in classrooms and 60 in lab environments."

Additionally, as the recent recipient of a California Career Pathways Trust Grant, the school district implemented the Innovation Design and Manufacturing Institute (IDMI). IDMI is a sequenced, curricular pathway where technology, manufacturing, and science meet design. IDMI provides a teaching and learning space where students have access to teacher facilitators, industry experts, and industry-standard software, technology, and equipment. A cluster of Sandia-donated computers will be placed into each of the school district's two IDMI model classrooms as hands-on learning spaces for technology and computing careers.

"As a result of this generous donation our district will be able to keep pace with technological needs of our faculty, staff, and students," says Chris Hartley, Superintendent of the Northern Humboldt Union High School District. "I appreciate the community-minded approach of Sandia National Laboratories and willingness to give back to education."

Mitch Williams (8136), electronics technologist at Sandia, spearheaded the donation through Sandia's K-12 Program, which allows government equipment donations to elementary and secondary schools. Mitch worked closely with Jack Euske and Terry Spraggins (both 8523) of the Sandia Property Management group and the school district to finalize the agreement and get the computers delivered to the school district.

Mitch says he drove by the school's closed campus one day and saw a single car in the parking lot and a single open door in a campus building and went in asked if there was a need for donated computers. The person put him in touch with the Todd Curry and was told that the school had a need for more systems than what Sandia could actually provide.

"I'm glad it all worked out," Mitch says. "Lots of students will benefit from the donation and most importantly the computers will help improve the math and science curricula at the schools."

Interns team with researchers in additive manufacturing design competition

Interns from three Sandia centers spent the summer coming up with innovative design ideas for mechanisms in nuclear weapons, using emerging additive manufacturing techniques and collaborating with Sandia's partners at the National Security Campus in Kansas City.

The inaugural Additive Manufacturing Discriminator Design Competition formed three teams under the sponsorship of senior managers: Team Components under Carl Vanecek (2610), Team Nuclear Safety under Tommy Woodall (430), and Team A&E (Advanced and Exploratory) under Anna Schauer (2240). Each team included a staff member sponsor from the organization and experts in safety from Org. 400, 3-D modeling from Org. 2900, manufacturing from the National Security Campus (NSC), materials from Org. 1800, and additive manufacturing from around Sandia.

WINNING TEAM — Senior Manager Mark Smith (1830) joins winners of Sandia's inaugural additive manufacturing contest for summer interns. From left to right are Mark, intern Yuanda Li, Arun Subbiah (2159), Kevin Knotts (2991), and intern Sarah Miller.

(Photo by Tommy Woodall)

"We started the competition to take advantage of emerging additive manufacturing capabilities, enhance our working relationship with our Kansas City/NSC partners, develop some out-of-the-box approaches to challenging requirements, and to aid in recruiting some top students," Tommy says.

Carl says the best ideas from the competition will help develop a roadmap of additive manufacturing technology needs for the future.

The contest, won by Team A&E, required teams to create additively manufactured discriminator concepts from design to prototype, using at least 50 percent additive manufacturing techniques. Discriminators are among the safety mechanisms in nuclear weapons.

"We chose discriminators because they present some of the biggest design and requirements challenges," Tommy says. Sandia researchers believe emerging techniques may offer design options that aren't possible with traditional approaches.

The contest drew about a dozen students, both graduate and undergraduate. Judges were Sandia senior managers and senior scientists, including Bill Ballard (8200), Mark Smith (1830), Cliff Renschler (2730), and Sandia Fellow Jerry Simmons (1000). NSC representatives were among more than three dozen people who attended briefings the teams conducted on their designs during judging in August.

Team sponsors called the contest a success. "New thinking emerged, the interns had a truly amazing summer experience, and I believe Carl, Tommy, and I jump-started the use of new production techniques to enable future designs," Anna says.

The competition was partially funded by Davina Kwon (8210) through the Enhanced Surety Engineering Program and by Ernie Wilson (2810) through the R&D Certification & Safety Program.

— *Sue Major Holmes*

Additive

(Continued from page 1)

Additive manufacturing opens up seemingly limitless possibilities. It can make shapes with complicated geometries that traditional machining can't handle. It offers the potential to integrate parts or assemblies, reducing the number of joints and other interfaces that could be points of failure. In the future, designers might be able to custom-tailor the properties of additive materials to make components better. All of those opportunities could save both time and money.

Understanding properties of new materials

The biggest barrier to using new materials is understanding their properties well enough to certify that they meet rigorous requirements for high-consequence applications. Materials assurance, a key to certification and qualification, is "the first, most immediate obstacle that we need to overcome," says manager Andre Claudet (2617).

Parts must meet multiple requirements for mechanical, thermal, or vibration performance — particularly crucial when something is intended for a nuclear weapon, a satellite, or an airplane. "How do you actually verify the material is what you want? For some applications it's not a big deal. For high-consequence hardware it's a very big deal," says Bradley Jared (1832).

The path to certification requires conducting experiments using instruments to understand what's happening and performing sophisticated computations to verify that material properties meet specifications.

Sandia is well-suited to tackle the problem because of its expertise in computational mechanics and analysis, high-performance computers, and modeling tools it developed. Sandia also has experience in handling large amounts of data, people who know how to write and adjust codes, skill in materials science, and a history of inventing additive manufacturing techniques. In the 1990s, Sandia developed both Laser Engineered Net Shaping (LENS), a process to print complex metal parts from powders, and robocasting, a 3-D ceramic process that forces ceramic slurry through a pressurized needle to create a part that is fired in a furnace to harden it. Both processes have been commercialized.

Most metal additive techniques involve melting a feedstock material that then re-solidifies into its final shape. However, the process alters a material's microstructure, which can dramatically affect its properties and how parts perform. Researchers need to understand how the extreme temperatures and heating and cooling rates affect material properties.

Metal parts historically have been made from ingots, rods, bars, or plates whose properties can be verified. "You can cut some samples and check the chemistry and the microstructure and mechanical properties and say, 'Yea verily, this is a good piece of material and anything you make out of it will be fine,'" says Senior Manager Mark Smith (1830). "With additive you build material at the same time you build the part. So the question is, does it have the right microstructure and chemical composition and are there defects like voids or unmelted particles that will affect its performance?"

> In the 1990s, Sandia developed both Laser Engineered Net Shaping (LENS), a process to print complex metal parts from powders, and robocasting, a 3-D ceramic process that forces ceramic slurry through a pressurized needle to create a part that is fired in a furnace to harden it. Both processes have been commercialized.

Strength, other characteristics affected by how materials are processed

Important material characteristics such as strength or ability to withstand stress depend on many things, including how a material's internal structure is affected by phase changes — for a simple analogy, think ice melting into water, then refreezing into ice again. In the laser metal powder bed process, for example, feedstock powder is random in the way it's laid down and in its distribution of particle sizes. As the laser scans the surface and melts some particles, they coalesce.

"The behavior of the final part depends on the metallic microstructure of the material from which it is built," says manager Anthony Geller (1516), whose department does modeling and simulation for fluid and multiphase flows. "The microstructure depends on the temperature history that the metal experienced while it was cooling, and the temperature history the metal experienced while it was cooling depends on the temperature and flow history of the particles as they were heated, melted, and flowed together, which in turn depends on that first step, how the particles were laid down."

Anthony says researchers must acknowledge the inherent variability of additive materials, and design according to probabilities for internal stress.

Embracing material variability is the broader goal of Sandia's Engineering of Materials Reliability Research Challenge, which is developing a framework to understand how variability impacts the reliability of engineering components. The research challenge is using the metal additive process for its initial study.

Additive manufacturing allows designers to create complex geometries that can't be made by traditional manufacturing. Given the triple constraints of cost, schedule, and performance, a complex part can be preferable: it's cheaper because you use less material and faster because you're printing less, and it performs better because optimization tools are used, Andre says. Sandia is developing computational tools incorporating technologies such as topology optimization (see story on next page) to take advantage of this aspect of additive manufacturing, he adds.

But it's very difficult to characterize complicated additive manufacturing parts such as a bar engineered for rigidity that resembles the skeleton of a cholla cactus. "From a production standpoint that's the part I want to make because it's faster and uses less material," Bradley says. "From a measurement standpoint, however, that part is a greater challenge."

Research must measure temperatures as structures form

For accurate simulations, researchers must know what happens as layers are put down, but it's difficult to measure temperatures in layers that become hidden as other layers form on top. "We can't embed anything in those lower layers because that would change the behavior," Anthony says.

Simulations, aimed at calculating real-world results using large computers, can predict temperatures in inaccessible layers, while experiments can validate the model. Simulations can study parameters such as particle size distribution that would be difficult and costly to study by experiments alone.

Diagnostics for the LENS process included a thermal camera to learn about the melting process and metallurgy, and Bradley suggests something similar for the powder bed process. Some studies have used optical cameras to see how the powder disperses on a layer and to study the powder laydown process. Some diagnostics might be able to use these types of sensors.

"Right now we don't have a whole lot of information coming off the machine and off the process," Bradley says. "We don't know what we don't know."

Understanding how materials form might eventually mean custom-tailoring microstructure properties.

"So you can have different material, different microstructures, different properties in different regions that can be incorporated as part of the design process if we can understand it well enough," Mark says. "That's sort of the long-term vision: You would not only design the geometry, but actually design the microstructure of the part as you build it."

Additive manufacturing is a tool, not a panacea, and won't replace traditional manufacturing for everything, he says. "We're not going to print a complex mechanical assembly with precision moving part anytime in the near future," he says. "But there may be some applications where it offers unique advantages for us."

Bradley expects it to complement current techniques. "Where you need it, you'll use it, and where you don't, you'll use traditional methods."

Topology optimization:
Creating the best design for the purpose

By Sue Major Holmes

Imagine a table with sinuous legs resembling the organic shapes of tree branches rather than straight table legs. Those flowing legs might make the table stronger, better able to handle whatever someone piles on it.

Sandia researchers believe such designs, achieved through a technology called topology optimization, could enable better parts for nuclear weapons, satellites, and other vital uses. Along with advanced additive manufacturing (AM) it opens possibilities for complex shapes that conventional manufacturing methods can't handle. Partnering the techniques also offers the potential to combine parts to save time and money, reduce the number of joints or other interfaces, and embed sensors or wiring within a structure as it's formed.

Before the technologies can be widely employed in high-reliability, high-consequence uses, however, researchers must understand how to create the best shapes for parts and guarantee material properties.

"There are aspects of this marriage between additive manufacturing and topology optimization that are going to be critical for us to address if we're really going to do this well," says manager Ted Blacker (1543). "If all you do is make the same old parts a new way, it's taking advantage of only a fraction of what is possible in additive manufacturing. And if you make these new optimal parts but you can't ensure material quality, they're of no use."

Sandia's expertise in computational mechanics, analysis tools it developed in engineering codes such as Sierra and Alegra, and geometry tools such as Cubit are advantages for working on those critical problems. Sandia also has experts in materials science and computational simulation of materials, experience in handling large amounts of data, and know-how in writing codes for high-performance computers.

Additive manufacturing, typically synonymous with 3-D printing, encompasses techniques to make parts or whole assemblies in plastic, ceramic, or metal.

Additive manufacturing handles complex shapes

New AM technologies, particularly those that produce metal, open possibilities for designs that previously were not realistic because they were too complex for conventional manufacturing. "We need to develop computational tools that will enable us to make the leap to new types of designs; tools that will make modern computer-aided design systems seem as quaint as drafting tables and T-squares," says manager Andre Claudet (2617).

Sandia is interested in additive manufacturing for nuclear weapons components because the technique can handle complex geometries and is particularly efficient for low-volume production. It's especially compelling early in product development, when frequent design changes can be quickly evaluated, says Bradley Jared (1832).

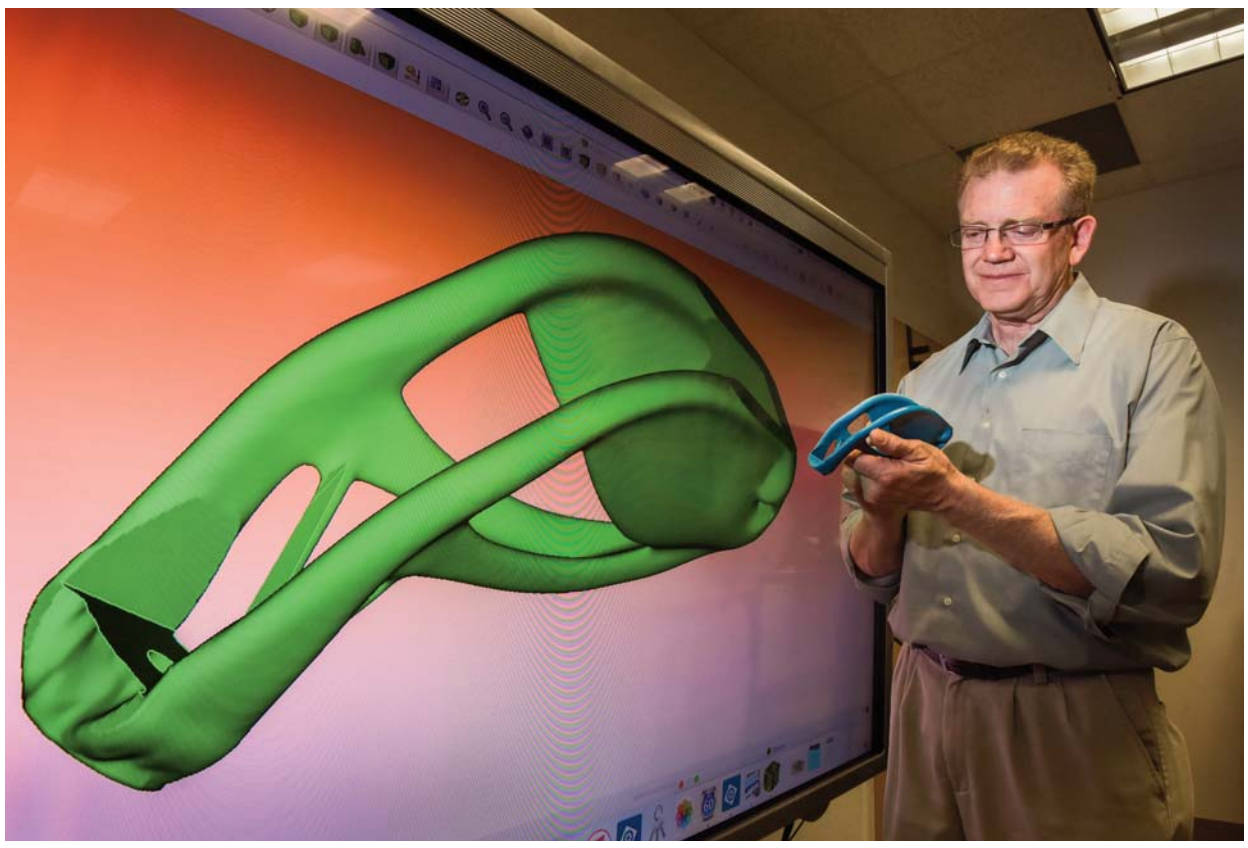
Additive manufacturing and topology optimization together could combine several pieces into one, eliminating possible weak points, saving material, and removing the need to model what could happen at those interfaces, Bradley says. "If you can combine interfaces, suddenly you've simplified a part for simulation, for testing, and for qualification," he says.

With topology optimization, engineers start with an allowable space — the area where the part fits — then specify functional requirements, "how heavy they will allow it to be, what material they want to use, the loads, and the constraints," Ted says. "They allow the optimization calculations to determine where the material is needed, placing material only where it will be used most effectively to meet design demands."

Thus, a designer no longer focuses on creating a shape, but is free to drive the design by the functions required. For example, a designer might choose tradeoffs between device rigidity and ability to conduct heat. Prioritizing stiffness produces a shell-like structure, with material pushed outward to maximize rigidity. If thermal transfer is more important, the optimization produces a structure with more massive legs, natural paths for heat. If stiffness and heat transfer are equally important, the result is a truss-like structure that adds stiffness but still has material in the legs.

Designers use computer-aided design programs to envision useful shapes for a function. But with topology optimization, that's reversed. They tell the program, "'Here are my engineering requirements; you create my geometry for me,' a major revolution in how we do design," Ted says.

He displayed a black plastic table and chair, inches in scale, an additive manufacturing example project that demonstrates how topology optimization works. The table top and chair seat are flat, but the organic-looking legs twist in shapes reminiscent of the inverted trunk of a swamp cypress.



TOPOLOGY OPTIMIZATION achieved the unique shape of the lantern bracket held by Ted Blacker (1543) and displayed in the topology optimization program behind him. The computer program started as a square block and, following parameters set by a designer, drew I-beam-like supports and plates with filleted attachments to reduce stress concentrators where one member meets another. (Photo by Randy Montoya)

> *"If all you do is make the same old parts a new way, it's taking advantage of only a fraction of what is possible in additive manufacturing. And if you make these new optimal parts but you can't ensure material quality, they're of no use."*
>
> **— Sandia Manager Ted Blacker**

Topology optimization program works from specifications

The project defined an allowable volume for the table and chair, fixed positions on the floor for legs, and stipulated flat surfaces for the tabletop and chair seat, along with uniform loads — the weight they bear — then let the topology optimization program do its thing.

It requires engineering judgment and carefully specifying the entire problem. Parameters such as feature size control whether you get a tree trunk or a more spider web structure holding up the tabletop. If you don't tell the program to secure the legs so the table doesn't move, it adds cross members along the floor to increase strength, even though that also prevents a chair from sliding under the table. "With topology optimization, you get what you asked for, whether that's what you wanted or not," Ted says.

Thus, topology optimization requires what he calls interactive steering. If engineers watching a shape form on a computer screen realize they didn't put in enough information, they can stop the program. "Where we stopped we say, 'Add this additional constraint,' and let it continue," Ted says. "Even though the calculations are being done in batch mode on very large machines, we can still have an interactive design environment on those machines. We think it's a very powerful addition."

Interactive steering paid off in a test problem to design a bicycle frame. The engineer identified requirements for a seat, handlebars, and pedals, something to hold the tires, and loads to simulate a rider standing on the pedals rather than sitting on the seat. But as the shape evolved on the screen, he realized the specified load on the handlebars was in the wrong direction. He stopped, made adjustments, and finished the design.

Engineering analysis to predict optimal shapes takes full advantage of AM, but poses an extremely difficult computational problem. Static loads, something sitting on top of a table, are easy to include. Dynamic loads, someone jumping on the table, are not.

Optimization requires not only high-performance computing capacity but also expertise in modeling to include as much physics as possible. "If you want a really good optimization, you've got to include every possible physical environment that a part will see," Ted says.

Simulating physics saves time, money

Manager Anthony Geller (1516) says it would be extremely expensive to use only experiments to understand the physics of how something works, and simulations save time and money. "If we need 100 tests, maybe we would do 90 of them through simulation and 10 of them experimentally for validation purposes. Also, the simulation gives us access to certain data points that would be difficult if not impossible to acquire through actual physical experiments," he says.

A program assumes certain materials properties as it follows specifications for a design. But sometimes engineers overbuild because they're uncertain about the properties. "The optimization says that if we have that tiny curved strut that's very thin, that's all the material you really need to carry the load," Anthony says. "But if we have to make it thicker because of our uncertainty, we're losing that benefit."

Ted says Sandia is working on "robust optimization," letting calculations derive a shape that will meet requirements with point-by-point uncertainties in material properties or in loading conditions. Such uncertainty quantification determines the likelihood of outcomes when some aspects of a problem aren't known, and predicts results in a statistical sense.

Senior manager Mark Smith (1830) says that in the near term, additive manufacturing could save time and money in tooling, fixtures, and jigs used in manufacturing components since those items don't have to be certified like an actual part. "We're already making very extensive use of additive in those areas," he says.

He believes Sandia can make significant progress in three to five years but says it could take a decade or more to reach the ultimate goal of design optimization, tying materials assurance and topology optimization together.

Researchers must balance what can be accomplished now with how much work is still needed to qualify parts for the stockpile. "I don't want to minimize the potential benefit but I also don't want to minimize that there's still a lot of work to be done," Anthony says.

45 individuals, 78 teams

2015 Employee Recognition Awards program honors teams, individuals for exceptional contributions

Sandia's prestigious Employee Recognition Awards are presented to individual employees and teams nominated by their peers and chosen by a division selection committee with final approval by the division VP for their accomplishments during the past year.

ERA awards underscore the importance placed on individual and team contributions to Sandia mission success. ERA categories include, for individuals, exceptional service, leadership, technical excellence, and Sandia values, ethics, and integrity. A teamwork award recognizes team accomplishments.

Sandia this year recognizes 45 individuals and 78 teams for their outstanding contributions to mission success.

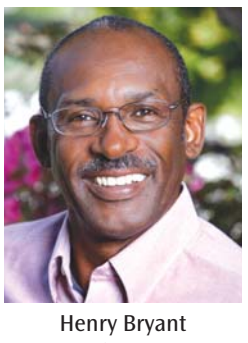
Individual honorees


Julia Baca
435


Timothy Bartel
6233


Adam Bradford
9542


C. Douglas Brown
9312


Henry Bryant
8517


Mary Bultmann
4853


Amber Cantwell
5403


Joshua Christian
6123


Harry Cincotta II
2917


Jeremy Cordova
5781


Joshua Cordova
6532


Robert Hemighaus
2716

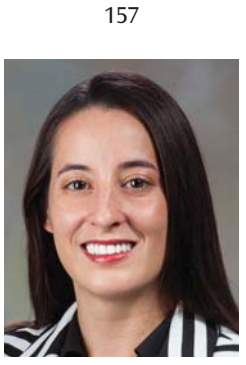

Patricia Hough
8954


Celedonio Jaramillo
4848


Ahren Jasper
8353


Terry Josserand
157


Randolph Kay
1753


Elizabeth Kivlighan
8521


Michael Kline
4246


Tony Kreuch
3334

Team honorees

Executive Support Division

DOE National Laboratory Day on the Hill
For Sandia's leadership in organizing this important outreach event for Secretary Moniz that raised awareness of the vital role of the DOE National Laboratory System.

MCCS/CAP Coded Switch Testing Team
The team successfully conducted testing to answer questions about the effectiveness of certain use control features of nuclear weapon coded switches in the current stockpile.

Quality Roundtable
For outstanding commitment and efforts to implement and proactively seek improvements to Sandia's quality-related workflows.

Sandia Family Day 2014
This exceptional team planned and delivered a successful, safe, and secure Sandia Family Day 2014 for over 12,000 Sandians and their families.

Division 1000

1400 Engineering and Software Quality Assurance Team
For delivering and supporting best-of-class tools to improve the quality of Sandia's software products and enhance developer productivity.

2014 PI Workshop Team
Identified an unmet need for training in how to be an effective Principal Investigator and took the initiative to design and host a full-day workshop.

B61-12 ERB Thermal Qualification Test Series
For successful integration of WSEAT (Weapon System Engineering Assessment Technology) and B61-12 Thermal Qualification efforts, and completion of the B61-12 ERB-1 abnormal thermal test.

B61-12 ME3 Acoustic Test Team
Executed a physical representation of B61-12 free-fall using computational fluid dynamics, structural dynamics, acoustics, and modal analysis to influence the environmental specification.

Department 1714 Biosafety Team
The Biosafety Team has shown extraordinary initiative and effort in identifying and addressing biosafety issues in Dept. 1714's Biological Safety Level 2 laboratories.

ES&H Coordinator Safety Case Review Team
The ES&H coordinators provided outstanding support for the Division Safety Case Management Review Teams. The coordinators demonstrated their professionalism and dedication to ES&H and engineered safety.

High Temperature Opacity Team
For material opacity measurements at temperatures exceeding 2 million degrees Kelvin, a breakthrough that resolves questions about our Sun and underpins the stockpile stewardship mission.

Packaging Advisory Board
The Packaging Advisory Board generously served Sandia's product realization communities.

Predicting Performance Margins
The Predicting Performance Margins (PPM) team has made substantial advances in multi-scale materials science with profound impacts on Sandia missions while nurturing key capabilities.

SGEMP "Blind Challenge" Team
For completing blind comparative simulations, with a collaborative partner, of System Generated EMP (SGEMP) in a 3-D weapons geometry using the RAMSES code suite.

Sierra Solid Mechanics Code Team
Impact on the computational solid mechanics community through pervasive use of its code across many NW systems, performance improvements, and attention to users.

SiFab Acid Exhaust Improvement to Wet Bench Systems #20, 22, and 23 Team
The team engineered an acid exhaust improvement that eliminated a brown cloud lingering above a wet chemical tank containing hazardous sulfuric nitric acid.

TA-V Annular Core Research Reactor (ACRR) Wide Range Nuclear Instrument Team
The Wide Range Nuclear Instrument project improved reliability and fidelity at the ACRR, significantly increasing feedback of reactor power levels and minimizing down time.

Ultra-fast X-Ray Imager (UXI) HIPPOGRIFF Camera System
The UXI team successfully developed a prototype, high speed, multi-frame, digital camera system for integration at Z and NIF to characterize high-energy-density physics experiments.

Division 2000

AHW-2 Telemetry Team and Flight Termination System Team
The successful development assembly, design qualification, flight certification, delivery, fielding and flight performance providing critical post-mission data.

B61 Joint Test Assembly Modernization (JTAM) Team
In recognition of the technical excellence, teamwork, and dedication demonstrated to realize the Systems First Production Unit (FPU) for B61 JTA Modernization.


INTERCONNECT TECHNOLOGY TEAM

B61 JTAM Design Definition Team
The JTAM Design Definition Team successfully completed and delivered the CAD models and engineering drawings to support the B61 JTAM first production units.

New Power Sources Production Team
Demonstrated outstanding workmanship while setting a record for the average number of MC3929 Thermal Batteries built per day.

HiPot Chiller Team
This small, diverse team covered all aspects of rapidly developing, qualifying, and performing a "cold-temperature NG HiPot test capability" to support W80 NG development.

Interconnect Technology Team
For exceptional work in 2014 delivering excellence in interconnect technologies.

Neutron Generator (NG) Capacity Modeling and Simulation Team
A multidisciplinary, cross-division team coalesced to develop production operation models that provide critical decision support for the Neutron Generator Enterprise.

Primary Standards Igniter Circuit Investigation Team
Detected and resolved issue with improperly identified Valhalla Igniter Testers.

Stronglink High Speed Video (HSV) and Accelerometer Sensing Characterization (ASC) Team
The HSV and ASC Team advanced Stronglink characterization techniques to help revolutionize state of health assessments and strengthen the profound understanding of these complex mechanisms.

T575 (T461 Leak-Detection Panel Replacement Project) Product Realization
In recognition of fielding a cost-effective replacement for the 48-year-old leak detector used by the Air Force during B61 Limited Life Component Exchanges.

TTR Test Operations Center (TOC) Modernization Team
For innovative modernization of the TTR TOC to modernize 40-year-old legacy systems; creating a next generation, adaptive command and control operations center.

W88 ALT 370 Flight Test Team
This team executed the delivery of two flight test bodies for the W88 ALT program, supporting the design and development of the system and components.

(Continued on next page)


Shanon Ledger
8532


Monica Lovato-Padilla
9000


Ronald Maes
2155


Shawn Martin
9525


Jason Martinez
10679


Leanna Minier
2554


Julian Murrieta
10595

(Continued from preceding page)


W87 SYSTEM TEST BED TEAM

W87 System Test Bed Team

The W87 Lab Surveillance Team elated their customers by overcoming numerous challenges in executing the first System Level Testing since 1998.

Division 3000

2014 Collective Bargaining Teams

Nominated for the successful negotiation of the MTC, OPEIU, and SPA Collective Bargaining Agreements within the approved parameters and without a work stoppage.

Advanced Hypersonic Warhead Flight-2 (AHW FT2) Sandia Optics Team

The Sandia Optics Team provided critical documentation and optics data for the buildup and launch of the AHW FT2 mission.

Creative Services Partners with the Department of Energy for "Lab Day on the Hill"

Center 3600 established a unified brand for "Lab Day on the Hill" reflecting the expansive research and technology developed at the 17 DOE laboratories.

Division 4000

Building 1091 – Corporate Records Storage, Facilities Project Team

For the Facilities Project Team executing a $4.5M General Plant Project ahead of schedule and under budget for Building 1091, Corporate Records Storage.

Explosive Injury at Site 9920 Accident Investigation Board (AIB)

The AIB successfully maximized the investigation as a learning experience, not just for Sandia, but for the entire DOE Complex.

DOE Order 420.1C Implementation Plan Development Team

For exceptional contributions and teamwork by Sandia SMEs and the Sandia Field Office to develop the implementation plan for the new DOE Order 420.1C.

Physical Security Lock & Key Rekey Project

The Level III security site-wide re-keying project was completed one month ahead of schedule and $5,000 under budget.

Security Interests System (SIS) Development Team

The Security Interests System is a corporate-wide tool developed to enhance security programs and provide the line with information regarding security areas.

Waste Isolation Pilot Plant Release Analysis Team

The WIPP Release Analysis team worked diligently to provide high-priority sample analysis in support of the February 2014 Radiological Release at WIPP.

Division 5000

Data Acquisition System (DAS) Redesign Team

The Data Acquisition System (DAS) Redesign team delivered the CONUS DAS and completed the design of the OCONUS DAS for the Major Satellite Ground Station.

Doc Holliday Team

The Doc Holliday team delivered critical analytics to the customer to meet some of its most important operational needs and gaps.

Driftwood Team

The Driftwood Team was able to deliver several critical capabilities that increased and improved the sponsor's abilities and effectiveness to meet its mission.

Engineering Systems Test and Evaluation Laboratories (ESTEL) Capability Team

Exceptional cross-disciplinary teamwork and innovation enabling a "core-like" foundation for Cyberspace Mission Area that uniquely positions Sandia with highly leveraged state-of-the-art Test and Evaluation capabilities.

Explosive Resumption Independent Review Team (IRT)

$100 million in explosive operations were resumed due to reviews performed by the IRT. Work, Planning, and Control were improved for operations used by DSA, IHNS, and NW.

Global Burst Detector (GBD) III-3 Team

The GBD III-3 team worked tirelessly to assemble, integrate, test, and deliver to the Air Force a payload that met or exceeded all performance requirements.

Neutron Sensor with Commercial CMOS

This team successfully demonstrated technical innovation integrating a novel neutron sensor into commercial CMOS, extending impact of their LDRD into customer and commercial manufacturing communities.

Project Mission Assurance Category Evaluation (PMACE) Automation Team

Outstanding support to the DSA PMU for the development of an automated DSA Project Mission Assurance Category Evaluation (PMACE) tool.

Radio-Frequency Communications Payload for Hypervelocity Projectile

For successful development and gun-launched demonstration of radio-frequency electronics and unique antenna concept supporting the Navy Hyper-Velocity Projectile Program.

Ratchet Clip: A Small-Footprint High Power Microwave (HPM) Source Development Team

The Ratchet Clip Team successfully developed a High Power Microwave source designed specifically for a unique target class; meeting technologically challenging, physically rigorous form-factor requirements.

Special Optical Filter Mission Algorithm Development Team

The Special Optical Filter Team developed three new optical filter algorithms required by the customer under extreme schedule pressure to address flight hardware behavior concerns.

Synthetic Multi-Spectral Signatures Modeling, Testing, and Databasing LDRD Team

The LDRD team successfully accomplished an innovative and unprecedented modeling effort for creating synthetic multi-spectral signatures and performed testing and data collection for signature validation.

Test Series I Penetrator Project Team for AFSMC Hypersonic Warhead Technology Program

For recognition of safely conducting and collecting first-of-a-kind terminal ballistics data for development of Hypersonic Penetrators and benchmarking of predictive codes.

Division 6000

Applied Electromagnetic Geophysics CRADA Team

Mathematical theory, numerical simulation, satellite imagery, and good geophysical field practice are combined to plan an important field data acquisition experiment for their CRADA customer.

Aviano ESS Design and Installation Team

Sandia National Laboratories completed an Electronic Security System (ESS) installation at Aviano Air Base Italy in support of the NATO facilities upgrade program.

Baseline Design of Ebola Sample Transportation System for Liberia

Demonstrated successful teaming to design, develop, and deliver a timely, robust solution to overcome challenges impeding Ebola sample transportation to combat the outbreak in Liberia.


BUILDING 1091 - CORPORATE RECORDS STORAGE, FACILITIES PROJECT TEAM

Deep Archer Explosives Tests

For the successful planning and execution of two complex explosive tests at a remote location using Engineered Safety principles.

Global Threat Reduction Initiative Domestic Program Team

Exceptional teamwork and project management enabled the Global Threat Reduction Initiative (GTRI) Domestic Team to implement security enhancements to 52 US buildings in FY14, reaching 336 buildings total.

Quadrennial Energy Review Resilience Metrics Team

The Department of Energy requested Sandia to develop and vet a set of quantitative resilience metrics for energy systems.

WIPP Technical Assessment Team

In-depth modeling and experimentation to ascertain the origin, mechanisms, and impacts of the radiation release at the Waste Isolation Pilot Plant.

Division 8000

B61 JTA Modernization (JTAM) Instrumentation Team

In recognition of achieving the component First Production Units (FPUs) in support of the JTA Modernization System FPU.

Biosafety Evaluation Team (BSET)

BSET is recognized for outstanding work in reviewing Sandia's biosafety and biosecurity practices and identifying areas for improvement in the laboratory's biosafety and biosecurity programs.

Cyber Technologies Academy Leadership Team

For exceptional work in planning and execution of the Cyber Technology Academy program which seeks to develop the next generation of cybersecurity experts.

Diversity and Inclusion Action Planning Team (DIAPT)

For making a significant contribution to improving diversity and inclusion at the California site through broad engagement and demonstrating inclusive behavior.


DIVERSITY AND INCLUSION ACTION PLANNING TEAM (DIAPT)

Property Management Equipment Donation Team

For innovation and perseverance in implementing a research equipment donation program which allows excess Sandia equipment to be given to educational institutions and nonprofit organizations.

(Continued on next page)


Justin Newcomer
415


Ward Patitz
5345

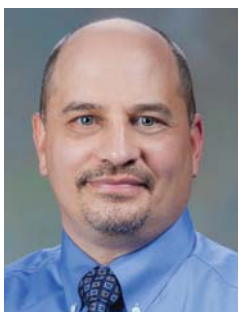

Tim Dwight Penner
2624

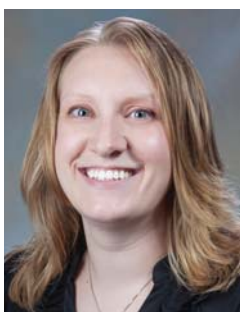

Cynthia Phillips
1400


David Pollock
5544


Jason Pratt
5332


Lourdes Romero
2128


Gregory Sabo
2913


Jonell Samberson
157


Anthony Sanders
5784


Dawn Skala
8238


Charles Skeens
10667

Melissa Soehnel
1512

Timothy Stirrup
4126

Dede Valerio
10617

Employee Recognition Awards 2015

Dann Ward
4128

Arlen Weishuhn
5966

Edmund Yu
1684

(Continued from preceding page)

Talent Development Team
Developed a Talent Development Model, which is an integrated, dynamic framework focusing on four core areas that drive 1:1 conversations between managers and employees.

W78/88-1 Phase 6.2 Study Team
The W78/88-1 Phase 6.2 study team created design options and program definition for the first interoperable reentry weapon to achieve stringent military requirements.

Division 9000

9540 Mobile Application Development Team
Sandia's Mobile Application Development Team executed the CIO's strategic direction with Mobile Expense Report (ER) and Mobile Timesheet, enabling a more effective and efficient workforce.

Cibola Predictive Model Team
The Cibola Team broke new ground by developing an innovative predictive model that will be deployed to assist in managing risks at Sandia National Laboratories.

HPC Annual Report with "SNL SimMagic" Augmented Reality Mobile Application
For delivery of the 2014 Annual HPC Report, including an innovative mobile technology that added Augmented Reality animation to the printed publication.

Oracle Database Infrastructure Migration Team
A multi-year effort to plan, design, test, and execute the replacement of the Enterprise Oracle Database infrastructure with x86/Linux capability.

Sky Bridge Supercomputer Design, Acquisition, and Production Readiness Team
This team designed, procured, and put into production "Sky Bridge," the most computationally powerful and most energy-efficient HPC platform ever sited at Sandia.

ORACLE DATABASE INFRASTRUCTURE MIGRATION TEAM

Division 10000

Contract Closeout Streamline Team
Innovative thinking and teamwork led to dramatic improvements to the contract closeout and audit closeout processes resulting in large cost avoidances and savings.

Corporate WFO Resource Team
Developing and presenting the 7-chapter series "Life of an Interagency Agreement at Sandia National Laboratories."

FY2014 Indirect Baseline Budget Team
Successful creation of the FY2014 Indirect Baseline Budget tool, resulting in a greater understanding of composition, cost drivers, and risks associated with IMS baseline budgets.

Lifecycle Materials Management Automated Acquisition Process Implementation Team
For outstanding cross-divisional teamwork on implementation of an automated review and approval process for acquisition of hazardous materials.

Dynamic Discounting Team
For outstanding achievement in making Dynamic Discounting a reality and creating significant cost savings for Sandia National Laboratories.

Division 11000

NNSA Administrative Policy 23 (NAP-23) Implementation Team
As the result of a new requirement from NNSA, Sandia stood up an Administrative Policy 23 (NAP-23) Implementation Team and subsequently became a complex-wide leader for the development and execution of NAP-23.

Real Robot Rescue

By Rebecca Brock • Photo by John Ledet

When Margaret Mora (4236-1) signed on to be an evaluator for the Robot Rodeo, she knew it would be a good experience. That said, she had no idea how soon after the rodeo she would apply what she'd learned about unmanned robots to her job on Sandia's emergency response team.

Less than two weeks after Robot Rodeo, which took place at the Labs, Emergency Management received a 911 call about a 30-gallon steel waste drum outside Bldg. 6505 that appeared to have a bulging lid.

Margaret arrived at the scene with Emergency Management and Security personnel including supervisor John Ledet (4236-1) and the Command Team of Rick Romero (4236-1) and Jim Romero (4236-2). The responders learned the drum contained a mixture of thermal spray metals and came to the conclusion that rain water had entered the container and caused a chemical reaction that pressurized the container. An emergency response Incident Action/Site Safety Plan was developed and Incident Command assigned responsibilities. Margaret and John discussed the need for a safe way to vent the still-bulging container, concerned about the potential danger it posed to first responders.

"Since I had just seen what robots were capable of during the Robot Rodeo," says Margaret, "John and I decided to call Jake Deuel to see if he had a robot on site that could drill a hole to relieve the pressure build-up. Even though we are all trained to do this kind of work ourselves, I was looking for the safest method to keep the people on our team out of harm's way."

Jake, manager of Robotic and Security Systems Dept. 6532 and coordinator of the Robot Rodeo, was in a meeting when he got the phone call from Incident Command. Under the direction of Incident Command, he arrived on the scene within 20 minutes with explosives operator Mike Heister (5438), Sandia manager Steve Marley (5438), and a Remotec HD-1 robot with a specialized drill.

Mike Heister, who was operating the Remotec HD-1, says, "When we arrived, Emergency Management did a really great job at briefing us and setting up Incident Command. They had the information ready and they knew the threats. It also helped that they knew Jake from Robot Rodeo so the communication made it easy to work together."

After a team-wide discussion about the risks of the venting process, controlling the risks, and stand-off distances, Incident Command decided the robot could approach the drum. Robot operators set up from a distance and the robot got to work, drilling a hole in the bulging, potentially flammable drum. Emergency planner Chris Mullaney (4236-1), who was working at the scene, says, "From 40 yards away and behind two fences, we heard this whooshing sound, like taking a spike out of a tire. There was a lot of pressure inside there."

After the robot vented the lid and checked the area for oxygen, first responders were able to approach the drum and remove the lid. The drum was safely removed from the scene and everyone left feeling like a tremendous team effort had been made.

"Credit goes to Jake and the robot operators who dropped everything they were doing that day and got there immediately," Chris says. "In emergency response, we cannot wait very long, so the fact that they rallied made the difference."

The robot, Remotec HD-1, did not suffer any damage from the incident.

Margaret recalls, "This is the first time we have used a robot for an emergency response on the Sandia site. Thanks to Jake involving those of us from Emergency Management in the Robot Rodeo, we were able to apply that training and work together at a real scenario."

SANDIA MANAGER Jake Deuel prepares a Remotec HD-1 robot for a real emergency incident at Sandia.

With a little help

Small NM businesses get a scientific leg up, and prosper

By Nancy Salem

Ski bums need fuel to schuss down mountains day in and day out. Their go-to snack is an energy bar, a backpack staple. "We need something that is quick, healthy, sustaining, and cheap," says Kyle Hawari of Taos.

But taste matters, too. "We humans crave something that is enjoyable to eat," Hawari says. "Simply put, we wanted something healthy that delivered in the taste department."

Hawari says the bars he tried were chalky and dry, and some had fillers and preservatives. Others were just plain bad. "There were many choices when it came to bars but none lived up to the fancy packaging or the hyped-up story on the back," he says. "We saw the same tired flavors, bad textures, and poor ingredients over and over again."

Hawari and his longtime friend and fellow outdoorsman Brooks Thostenson thought they could do better and in 2010 set out to craft a line of artisan energy bars using premium, organic ingredients. "There's a legend in Taos that if the mountain calls you there to make art, you have little choice but to surrender," he says. "Well, we heard it calling."

Hawari and Thostenson founded Taos Mountain Energy Foods LLC using the community kitchen at the Taos Food Center. Their first sales were in New Mexico but distribution quickly expanded throughout the United States. Hawari and Thostenson were overwhelmed.

They turned to the New Mexico Small Business Assistance (NMSBA) program for help streamlining production and were paired with the New Mexico Manufacturing Extension Partnership, which contracts with NMSBA. It helped the company reduce cooking times, automate manual processes, and improve how products flowed from customer order to receipt and fulfillment.

Taos Mountain Energy Foods cut costs by $120,000 and, along with a Los Alamos Venture Acceleration Fund award, expanded to a 10,000-square-foot manufacturing center in Questa. The company employs 17 people.

"NMSBA helped me tap into high-level resources and expertise," Hawari says. "Our company has grown into a national outdoor lifestyle brand. I couldn't be happier with how it all panned out."

OLD FRIENDS, NEW ENTREPRENEURS — Taos Mountain Energy Foods founders Kyle Hawari, left, and Brooks Thostenson weren't prepared for the success of their organic power bars. The self-described ski bums got help from the New Mexico Small Business Assistance program on the road to building a nationwide business. (Photo by Sandra Valdez)

Millions of dollars' worth of expertise

Taos Mountain Energy Foods was among 352 small businesses in 31 counties that participated during 2014 in NMSBA, a public-private partnership among Sandia, Los Alamos National Laboratory, and the state of New Mexico that connects small business owners with scientists and engineers who provide technical assistance. The program also contracts with the New Mexico Manufacturing Extension Partnership, University of New Mexico Management of Technology program at the Anderson School of Management, Arrowhead Center at New Mexico State University, and the New Mexico Tech Department of Management. NMSBA provided $4.7 million worth of assistance to New Mexico small businesses last year.

> *"There's a legend in Taos that if the mountain calls you there to make art, you have little choice but to surrender. Well, we heard it calling."*

Ten projects that achieved outstanding innovations through the program in 2014 were honored in a series of six events held statewide through August 18. Taos Mountain Energy Foods received the Honorable Speaker Ben Luján Award for Small Business Excellence as the honoree that demonstrated the most economic impact. The award was presented by the late New Mexico House speaker's son, US Rep. Ben Ray Luján.

"NMSBA is a partnership that generates jobs and economic wealth in our state. It has created and retained more than 4,000 jobs," says Jackie Kerby Moore, manager of Technology and Economic Development Dept. 7933. "We are grateful to the principal investigators who work with New Mexico's small businesses. Together they are implementing innovative ideas and stimulating our state's economy. It is a powerful tool."

On the road

The six NMSBA events brought together small businesses, local economic development representatives, elected officials, and community leaders. Panel discussions with past NMSBA participants let company owners share their experiences and encourage others to join. And laboratory project managers were on hand to answer questions.

"Instead of a single awards ceremony, we decided to do it differently this year and take the event on the road," Jackie says. "We wanted to celebrate with the businesses in their back yards with their community leaders. It was more personal."

The first gathering was May 6 at the Taos County Economic Development Corp. Taos Mountain Energy Foods was recognized as a 2014 NMSBA success story with Mayor Dan Barrone, State Sen. Carlos Cisneros, and State Rep. Bobby Gonzales on hand.

The next stop was May 27 at the Arrowhead Center at NMSU. Fundamentalist Flowerchild Productions, a Mimbres Valley film animation company, was named a success story. Las Cruces Mayor Pro Tem Greg Smith and State Rep. Doreen Gallegos attended.

On July 22, KemKey LLC, which makes transfer fittings for the chemical industry, was recognized as a success story at an event at Katrina's East Mountain Grill in Edgewood attended by State Sen. Sue Wilson Beffort and State Rep. Matthew McQueen. The company worked with Sandia's Juan Romero (1832) on three-dimensional modeling to develop prototypes and designs.

A gathering Aug. 5 in Santa Fe honored three companies that participated together in what is known as an NMSBA leveraged project: Earth System Sciences LLC, Geo-Risk, and Terramar Inc., which are developing a software tool to evaluate geothermal resources. The lighting company iBeam Materials Inc. and Pharma Connect Express, which created software linking pharmaceutical reps and physicians, also were named success stories.

'The state should be proud'

On Aug. 12, Sisneros Brothers Manufacturing LLC, which makes prefabricated ductwork, was honored in Belen. Mayor Jerah Cordova, State Sen. Michael Sanchez, and State Rep. Don Tripp were on hand. Sisneros Brothers worked with Sandia PIs John Robert Laing (1851) and Thomas Bosiljevac (1558) on tensile and lateral testing.

"NMSBA is a major benefit offered by the national laboratories," Tripp, the House Speaker, said. "Scientists provide a level of expertise most small businesses cannot afford. The state really gets its money's worth."

Sanchez, the Senate Majority Leader, said the program not only helps small businesses but the communities where they are based. "These businesses thrive and support the area with jobs and other economic stimulus," he said. "This is one of the most successful programs New Mexico has ever started. The state should be proud."

Three NMSBA participants were honored at the final event Aug. 18 in Albuquerque, which was attended by State Rep. Gail Chasey: Facility Facts, which makes emergency-response software; IC Tech Inc., which developed automated water-flow monitoring systems and worked with Sandians Don Small (5348) and Michael Holzrichter (5335); and the leveraged program group TriLumina Corp., Dynamic Photonics Inc., 3D Glass Solutions, Theta Plate Inc., and Ideium Inc., which produce laser arrays. They worked with Sandia PI Robert Brocato (1751) on a laser-array submount assembly.

"There's a great synergy to NMSBA," State Sen. Gerard Ortiz y Pino said at the Albuquerque event. "The resources of a place like Sandia are applied to real-world problems. How will we break the cycle of poverty in New Mexico? We need everything we can get. NMSBA is an example of how government can provide a tremendous shot in the arm for entrepreneurs in the private sector."

NMSBA was created in 2000 by the state legislature to bring national laboratory technology and expertise to small businesses in New Mexico, promoting economic development with an emphasis on rural areas. The program has provided more than 2,300 small businesses in all 33 New Mexico counties with $43.7 million worth of research hours and materials. It has helped create and retain 4,086 New Mexico jobs at an average salary of $38,488, increase small companies' revenues by $200 million, and decrease their operating costs by $85 million. These companies have invested $68.3 million in other New Mexico goods and services and received $77.1 million in new funding and financing.

For further information about NMSBA, call Genaro Montoya at (505) 284-0625 or visit www.NMSBAprogram.org.

Mileposts

New Mexico photos by Michelle Fleming


Lisa Mondy
35 1516


Pam Puissant
35 4142


Danny Rey
35 2731


David Vehar
35 1384


Thomas Zipperian
35 2700


Becky March
30 10616


Brent Meyer
30 2622


Jeff Tsao
30 1120


Craig Wilcox
30 5351

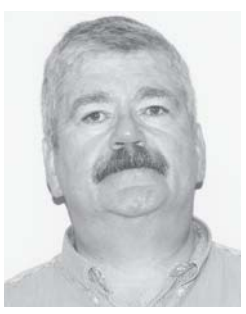

Connie Adams
25 10657


Gail Beach
25 754


Joe Clement
25 5644


Daren Davidson
25 5417


Bruce Hendrickson
25 1400


Lonnie Martin
25 1384


Brian Thomson
25 4128


David Aldridge
20 6913


Steve Coffing
20 4126


Felicia Duran
20 6612


Dan Small
20 6533


Amalie Frischknecht
15 1814


Carly George
15 4255


Thomas Hieb
15 2953


Colleen Koenig
15 2951


Enid Kuhns
15 91


Gabriel Pacheco
15 4241


Mark Watkins
15 2955

Sandians honored as 2015 HENAAC winners

(Continued from page 12)

His parents were teachers and education became a refuge. “I remember at a very young age looking at books sometimes by candlelight, studying the solar system. I was fascinated by science,” he says.

Abraham (pronounced Ah-brám in Spanish) got good grades, and the family moved to the city of Santiago as he went from elementary to middle school. “After I graduated from a science high school in Santiago, I decided I was going to become a doctor,” he says.

He went to medical school in Panama, but things changed when he got a scholarship to New Mexico State University to study engineering.

A bachelor’s degree in electrical engineering and power systems led to a master’s and a doctorate, all from NMSU in Las Cruces, New Mexico. Abraham met his wife Bernadette, now a teacher in the Albuquerque Public Schools, at NMSU and started a family. And he went to work, while getting his doctorate, applying solar and wind energy to rural development in Mexico, Central America, and South America. The work was sponsored by DOE with technical monitors from Sandia.

“The work was difficult, but very rewarding,” Abraham says. “My job was to design and install water pumping and lighting systems in remote places and educate people on how to operate and maintain them. It was very hands-on. We helped to literally change the way people went about life. We were on the front lines of rural development, working hand-in-hand with farmers and communities.”

Abraham worked eight years for Public Service Company of New Mexico in Albuquerque, figuring out how to integrate wind energy into power systems. “I had always been attracted to renewable energy,” he says.

His work at PNM kept him in touch with Sandia. When an opportunity to join Sandia’s solar group came up in 2008, he jumped at it. “I saw this as an opportunity to use my background in renewables and power systems to tackle national-scale challenges,” Abraham says.

Sandia’s research on integration of solar and other renewables into the grid has grown considerably, due in part to Abraham’s work. “I believe that this is the challenge of our times, to figure out a way to get massive amounts of renewables connected to the grid,” Abraham says. “Sandia is contributing significantly to solving this puzzle.”

At Sandia, Abraham has gone from being a principal investigator to a team lead for photovoltaic systems integration to department manager. “I am a professional researcher here and I get to think about the next challenge we should be working on,” he says. “I love that.”

Abraham, who plays congas with his son in his church band and does STEM outreach with NMSU and Albuquerque schools, says he has been most influenced in his life by his wife and kids, Abraham and Analiese, by his high school math teacher Cesar García, and by Satish Ranade, his PhD adviser at NMSU.

But it was the freedom and safety he felt where he grew up that most shaped his encompassing world view. “The place itself does something to your spirit,” he says. “I felt well protected by family and people that surrounded me. I carry a strong belief that people are fundamentally good.”

SANDIA CLASSIFIED ADS

MISCELLANEOUS

BUILT-IN DISHWASHER, Bosch, stainless steel, 2 yrs. new, $350; wrought iron patio set, table, 4 chairs (2 rockers), $250. Harrington, 505-235-6982.

BIB SKI PANTS, women's, Columbia, black, new, size L, $25. Steiner, 379-9977, after 4:30 p.m.

WEIGHT BENCH, Olympic, w/leg press attachment & squat rack, $50; 300-lb. weight set plus bar, Olympic, $80. Ruggirello, 505-221-7002.

APPLE WOOD, call for details, you haul, free. Palya, 321-6421.

ELECTRIC GUITAR, Guild Starfire III, hollow body, red, w/case, $999; Nikon 24-70 mm, f2.8G wide angle lens, $1,599. Demosthenous, 505-331-6783.

HOME-THEATER SECTIONAL, w/power recliner/chaise, 7-pc., $2,500; 10-ft. dining table, w/10 chairs, $2,000; never used, negotiable. Silva, 505-274-1019.

TWIN SLEEPER SOFA, 55"W x 36"D x 33"H, fabric, beige, +2 pillows, barely used, excellent condition, $500, negotiable. Edenburn, 505-869-2911.

LEOPARD GECKO, w/habitat & heat lamp, free to good home. Muhlberger, 362-8731.

HUGE FIVE-FAMILY YARD SALE, Sept. 19-20, 8 a.m.-2 p.m., Four Hills North, off Hwy. 333 frontage road, just past Believer's Center. Garcia, 280-5815.

STEP LADDER, 5-ft., aluminum, $20; extension ladder, 20-ft., aluminum, $50. Stubblefield, 263-3468.

ADULT EXERCISE TRIKE, Trike 8, $40; XBox video game systems w/accessories & games, $70. Flores, 610-2374.

SOFA, rocking chair, ottoman, excellent condition, $100/set; entertainment unit, $75; refurbished icebox, $150; Sony speakers, $50. Padilla, 822-9622.

LAWNMOWER, Neuton, battery-powered, model CE-5.3, w/trimmer attachment, very lightweight, $180. Colgan, 344-3776.

ANDROID TABLET, Zeki, 8-in., w/case/stand, original pkg., $40; office chair, adjustable, padded, good condition, $30. Purcell, 296-0377.

GOLF CLUBS: Callaway graphite irons w/bag, $60; Creeper, under-auto rolling slider tool, $25. Philbin, 828-2414.

COUCH, brown, full-size, like new, $300. Arning, 256-9229.

SOCCER GOAL, w/o net, 12' x 6', $40, negotiable. Brewster, 238-4704, ask for Julie.

RUMMAGE SALE, Eldorado High drill team, Sept 19, 7:30 a.m.-1:30 p.m., SE corner of Juan Tabo/Menaul, parking lot west of Ross. Callow, 505-217-3796.

RECUMBENT BIKE, Horizon Comfort, like new, receipt & owner's manuals available, paid $986, asking $500. Denaple, 298-2778.

PHONE/FAX, Brother, used 4 times, $45; Schwinn Airdyne workout for arms/legs w/gel seat cover, $185. Grenfell, 620-5745.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.
Submit by one of these methods:

- **EMAIL: Michelle Fleming (classads@sandia.gov)**
- **FAX: 844-0645**
- **MAIL: MS 1468 (Dept. 3651)**
- **INTERNAL WEB: On internal web homepage, click on News Center, then on *Lab News* link, and then on the very top of *Lab News* homepage "Submit a Classified Ad."**

If you have questions, call Michelle at 844-4902.

Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

SUNCATHER SOLAR THERMAL, complete system, 6 panels, 2 tanks, pumps, exchanger, blowers, electronics, pipes, $8,000. Lebien, 505-459-4074.

SOFA, love seat, chair and a half, $200; solid oak entertainment center, $300; all from La-Z-Boy, email for photos. McMahon, 505-259-4883, kamcmah@comcast.net.

SCUBA GEAR, large, men's, 2 wet suits, BC, octopus w/regulators, computer, great condition, make offer. Mead, 323-2253.

RECLINING SOFA, La-Z-Boy, $500; glass door curio cabinet, $100; dining room table, 6 chairs, 2 leaves, $150. Graham, 379-8798.

GARAGE SALE, Sept. 18 & 19, 8 a.m.-12:30 p.m., 1502 Mimbres Canyon Place, between Lomas/Indian School, east of Tramway. Giese, 505-332-8212.

BERBER CARPET, new, 100-sq. ft., $20; scaffold plank, 10' x 18", $5; electric drain cleaner, 1/3-hp, $20. Kerschen, 821-2848.

TRANSPORTATION

'01 BUICK PARK AVENUE, leather, AC, AT, 104.5K miles, $1,500. Graham, 505-271-1337.

'05 VOLVO XC90, leather, 3rd row seating, 117K original miles, 1 owner, Carfax July 22, $7,200. Lopez, 505-604-3053.

'93 JAGUAR XJS, 4.0L, 6-cyl., AT, new tires, 86K miles, runs great, $2,750. Stephens, 505-985-4617.

RECREATION

'14 SUZUKI C-50 B.O.S.S. MOTORCYCLE, black, 1,697 miles, lots of extras, like new, $7,000. Phelps, 336-935-1906, ask for Marcella.

REAL ESTATE

7-BDR. HOME, 4,992-sq. ft., ranch-style, walk-out basement, 2 acres, East Mountains, 24 mins. to Sandia, MLS#842530, $424,900. Weaver, 480-9951.

VACANT LAND, Tome, NM, near Tome Hill & UNM extension, $55,000/acre, owner will negotiate price. Ramos, 304-593-3425 or 304-562-8546.

2-BDR. HOME, fully furnished, on 2.346 acres, Timberon NM, $77,900. Argeanas, 299-3294.

2-BDR. TOWNHOUSE, 2 baths, 1,667-sq. ft., kiva fireplace, stainless appliances, 1-car garage, 2-car carport, 7543 Northridge NE, $177,000. Dubuque, 505-280-3132.

5-BDR. HOME, 3 baths, 2,600-sq. ft., excellent floor plan, Mossman tri-level, near Sandia High, Madison middle, Comanche elementary, $350,000. Norwood, 331-8608, ask for Fred

ONE ACRE, mountain cabin site, Mora, NM, 40 miles from Taos & Angel Fire. Romero, 505-877-9700, ask for Cordelia.

WANTED

'BOOK OF MORMON' TICKETS, 2, any date. Wolfgang, 414-1483.

RECENT PATENTS

Note: Patents listed here include the names of active and retired Sandians only; former Sandians and non-Sandia inventors are not included. Following the listing each patent is a patent number, which is searchable at the US Patent and Trademark Office website (www.uspto.gov).

Scott E.Bisson (8128), and Daniel Beom Soo Soh (8128): All Fiber Passively Q-Switched Laser. Patent No. 9,031,098.

Ryan Helinski (5627), Jason Hamlet (5627), Thomas Gurrieri (1753), and Todd Bauer (1746): Area-Efficient Physically Unclonable Function Circuit Architecture. Patent No. 9,018,972.

Stanley Atcitty (6111): Automatic Computation of Transfer Functions. Patent No. 9,009,640.

Mark J. Monda (6532), Justin Garretson (6631), Clinton G. Hobart (6532), and Thomas S. Gladwell (6532): Automatic Tool Alignment in a Backscatter X-ray Scanning System. Patent No. 9,055,886.

Leo Bynum (6813), Mark R. Gramann, (5447) and Larry D. Bacon (5443): Cross-Band Broadcasting. Patent No. 9,065,716.

Anson Hatch (8621) and Anup K. Singh (8620): Devices, Systems, and Methods for Microscale Isoelectric Fractionation Patent No. 9,005,417.

William A. Zortman (5645): Electro-Refractive Photonic Device. Patent No. 9,052,535.

Joseph Gabriel Cordaro (8223), Patrick L. Feng (8126), Mitchell Anstey (8625), and Alfredo M. Morales (8126): Hybrid Scintillators for Neutron Discrimination. Patent No. 9,029,807.

Joseph S. Schoeniger (8633): Methods and Materials for Deconstruction of Biomass for Biofuels Production. Patent No. 9,024,111.

Yifeng Wang (6222), Jessica Nicole Kruichak (6222) and Charles R. Bryan (6225): Methods of Capturing and Immobilizing Radioactive Nuclei With Metal Flourite-Based Inorganic Materials. Patent No. 9,000,250.

William A. Stygar (1651) and Michael G. Mazarakis (1656): Linear Transformer Driver for Pulse Generation. Patent No. 9,000,625

Patent No. 9,000,625

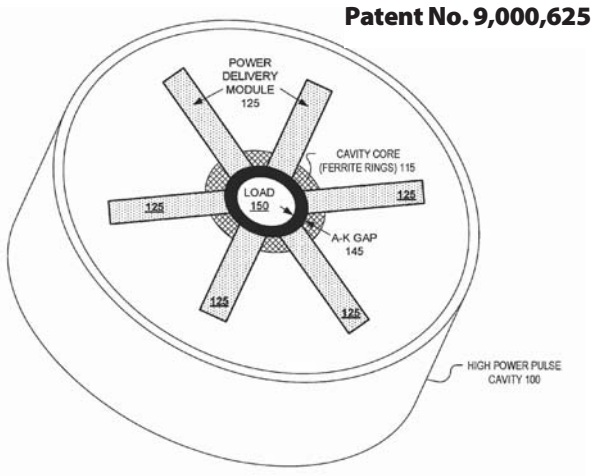


FIG. 1A

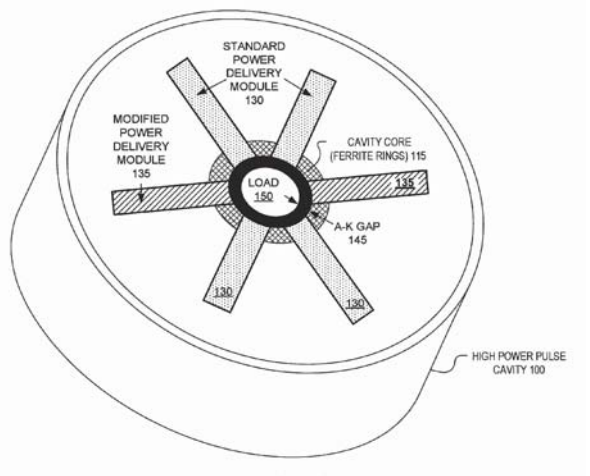


FIG. 1B

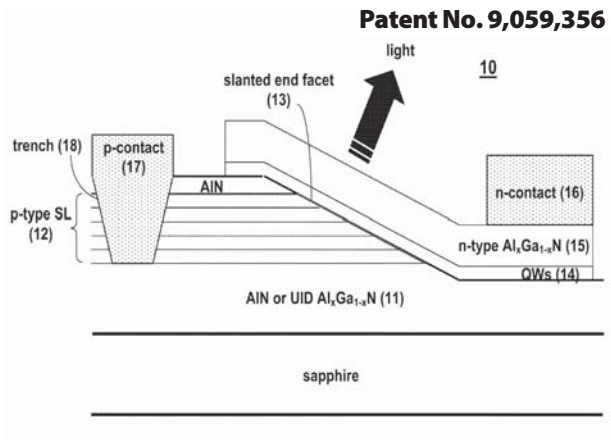
William C.Sweatt, (1516) Murat Okandan (1719): Microsystem Enabled Photovoltaic Modules and Systems. Patent No. 9,029,681.

Igal Brener (1765), Jeremy Benjamin Wright (5331), Subramania Ganapathi (1123) and George T. Wang (1126): Multicolor Photonic Crystal Laser Array. Patent No. 9,020,005.

Jonathan Roger Van Houten (2623), Jorge Mario Urrea (5624), John Mulder (05628), Jennifer M. Depoy (5620), Michael Aaron King (5624), Abraham Anthony Clements (5627), Michael Berg (6612) and Joshua Jacob (2623): PLC Backplane Analyzer for Field Forensics and Intrusion Detection. Patent No. 9,032,522.

Mary H. Crawford (1100), Mary A. Miller (1755) and Andrew A. Allerman (1126): Laterally-Injected Light-Emitting Diode and Laser Diode. Patent No. 9,059,356.

Patent No. 9,059,356



Nicolas Bikhazi (5774) and Hung D. Nguyen (5773): Remote Sensing Using MIMO Systems. Patent No. 9,019,148.

Anna Tauke-Pedretti (1766) and Jeffrey G. Cederberg (1126): Separating Semiconductor Devices From Substrate By Etching Graded Composition Release Layer Disposed Between Semiconductor Devices and Substrate Including Forming Protuberances That Reduce Striction. Patent No. 9,029,239.

C. Jeffrey Brinker (1000): Superhydrophobic Aerogel that does not require per-fluoro compounds or contain any fluorine. Patent No. 9,040,435.

SHARED TRADITIONS

Sandia HENAAC honorees find common threads in diversity

By Nancy Salem

Thousands of miles separate the hometowns of Patrick Sena and Abraham Ellis. Pat grew up in Santa Fe, New Mexico, and Abraham in Chitre, Panama, but they shared upbringings centered on family, community, and culture.

"What does it mean to be Hispanic?" says Abraham, manager of Photovoltaic & Distributed systems Dept. 6112. "I think about it a lot. Our culture is rich and diverse, and that's a good thing. The world I grew up in was totally different from Pat's, but in many ways the same. There is so much diversity there."

Pat says his family preserves behaviors and traditions handed down through generations. "There are important behaviors of respect, and how we treat and help each other; and traditions for celebrating our faith and life's milestones," says Pat, senior engineer for the deputy chief engineer for New Mexico Stockpile Systems Center 2200. "I represent one of the major ethnicities in the world and it means a lot to me to represent it well and also to be an effective contributor to national security and a better world along with the mix of all the talented people from all the ethnic groups that come together at a place like Sandia. We draw strength from each other."

WEDDING SINGER — Patrick Sena didn't make a career out of music but still sings and plays guitar. "Once I was asked to sing at the wedding of a Sandia colleague. When I came out from the back of the church to the altar and looked around I saw Sandians everywhere," Pat says. "They looked at me like, 'What's Pat doing up there? He plays guitar?' I had to sing in front of a bunch of people I worked with. It was a funny moment." (Photo by Randy Montoya)

Pat and Abraham were named 2015 HENAAC Award winners, Pat for Lifetime Achievement and Abraham for Outstanding Technical Achievement, by Great Minds in STEM. They will join other honorees at the 27th annual HENAAC conference in Pasadena, California, Oct. 14-18.

HENAAC, formerly the Hispanic Engineering National Achievement Awards Corp., honors the best STEM minds in the country. Each winner is peer-reviewed and chosen by representatives of industry, government, military, and academic institutions. Great Minds in STEM also helps promote those fields to youth from underserved and underrepresented communities.

Pat and Abe are the 33rd and 34th Sandians to win the prestigious award in the past 19 years. Both said they were humbled and hope to use the recognition to motivate others. "I have a renewed sense of purpose," Abe says. "I want minorities to play a larger role in our country in STEM. It's a goal worth fighting for, and I'll do that any day."

Pat says young people need role models and mentors. "I want to share my story to inspire them about how the elements of creativity, motivation, curiosity, work ethic, work/life balance, and communication can propel them into a rewarding and impactful career in STEM," he says.

Patrick Sena: Rejection with a happy ending

Pat was raised in a family of 10 kids, five boys and five girls. Older took care of younger, and they grew close to each other and a vast extended family in the area around Santa Fe and Villanueva, New Mexico. "Every day of our lives was involved with family," he says. "On many weekends we helped on our grandparents' farms and ranches, from weeding fields to baling hay to harvesting crops."

Pat's father worked as a mechanic, prison guard, draftsman, truck driver, and plumber. "My parents did a lot of things around the house themselves, and they taught us to do the same," Pat says. "They came from a hard-working and simple background. They raised us with morals, values, and high expectations. We were strong and happy."

The kids changed tires, overhauled and repaired engines, installed plumbing, and mastered many types of tools. "I really liked fixing things," Pat says. "The seeds were planted for me to become a mechanical engineer since my early years."

But Pat also loved music and wanted to be a professional musician. He chose New Mexico State University for college and went straight to the music department to sign up for classes. The department head gave Pat an audition.

"He said, 'Here's a piece of music. Read it and sing.' I told him I don't read music and he said that was a problem. He said I should pursue a different degree," Pat says. "Really? Just like that it's over? I asked if I could learn to read music and come back, but he said that would take a long time."

Pat thought about his dad, and working on cars, trucks, and plumbing. "Hmmmm … engineering. I walked across campus and signed up for mechanical engineering," Pat says. "They put an arm around me and welcomed me on the spot."

Pat went through NMSU with his high school sweetheart Kerrie, a math and computer science major who he married in 1978. A Sandia recruiter heard of them and came knocking. "We interviewed and loved Sandia," Pat says. "We thought we'd work here five years then move home to Santa Fe. That was 35 years ago."

Pat's Sandia career has taken him from being lead engineer on a security system installed in Europe to coming up with ways to protect US facilities overseas from terrorist attacks to managing departments and programs in the nuclear weapons program.

"I've been like a kid in a candy store," Pat says. "I've traveled all over the world and seen my designs installed and working. It's been very satisfying to help the world and ensure a strong nuclear deterrent. I consider it a mission for our country."

Pat and Kerrie, who left Sandia after a few years to become a teacher, have four children and 10 grandchildren. Pat mentors at Sandia and does STEM outreach in schools. He is becoming a deacon in the Catholic Church.

He says the biggest influence in his life has been his father. "He gave me opportunities and made me feel important, like I could do anything," Pat says. His parents are still alive and the immediate family of 65 gathers frequently in Santa Fe.

Pat still plays guitar and sings in church and at events. And he has learned to read music. "But I have to go back and thank the head of the music department for rejecting me so I could open my mind to engineering," Pat says. "It's been a great career."

Abraham Ellis: The challenge of our times

A tiny town in a coffee-growing region of Panama was Abraham's childhood home. He and his four siblings grew up exploring mountains, valleys, and rivers.

"It was a remote location that was hard to get to on steep, unpaved roads," he says. "There was no electricity, no supermarkets, no phones, no cars, no electronics — just nature. It was a beautiful place. There were lots things for kids to do in the area and we were not shy about exploring. We felt completely free. We were fearless, self-driven, and self-sufficient."

(Continued om page 10)

MR. FIX-IT — Abraham Ellis loves to tinker in his garage. "I spend more time than I should figuring out if I can get another year out of my washing machine or dryer," he says. "I fix a lot of stuff." (Photo by Randy Montoya)

Hispanic Heritage Month 2015
'Honoring our heritage. Building our future.'
'Honorando nuestra herencia. Construiendo nuestro futuro.'

Sept 22: Hispanic Heritage Breakfast*

- 7:30-9 a.m. – KAFB Mountain View Club
  Guest speaker, dancing by National Institute of Flamenco
  Tickets - $12, RSVP at http://tiny.sandia.gov/y0t6c

Sept 23: Hispanic Heritage Cultural Bilingual Readings*

Volunteers will read bilingual books to children

- 10 a.m. at KAFB Child Development Centers
- 2 p.m. at KAFB Youth Center

Sept 23: Diversity Day at Steve Schiff Auditorium

- 9 a.m.-1 p.m. – Open voting for student art contest; View and judge amazing art
- 10 a.m.-11 a.m. – HENAAC Award Winner Panel – Come hear insights from recent recipients of the prestigious Hispanic Engineer National Achievement Awards Conference
- 11-11:30 a.m. – Flamenco Dancers - Tierra Adentro of New Mexico: The New Mexico School of Academics, Art & Artesania
- 11:30 a.m.-1 p.m. – Hispanic Food Tasting – Sample salsas, desserts, and other delicious foods

Sept 25 Hispanic Heritage Culture and Art Talks w/Food Sampling*

KAFB Theater (Free admission)

- 2 p.m. Garcia's Kitchen food sampling
- 2:30 p.m. Guest speakers on New Mexico art and culture - Andrew Connors & Rob Martinez

Sept 25: Hispanic Heritage Movie Under the Stars "McFarland USA"* (Free admission)

- 7:30 p.m. at Hardin Field (Base Theater is backup in case of inclement weather)

Popcorn and refreshments will be provided

* * *

Look for Hispanic culture fun facts in the *Sandia Daily News* during Hispanic Heritage Month!

*Sponsored by KAFB

LEADERSHIP & OUTREACH HISPANIC COMMITTEE